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TECHNICAL DATA SHEET FOR GASES CONVEYED IN CYLINDERS

BUREAU OF INDIAN STANDARDS

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TECHNICAL DATA SHEET FOR GASES CONVEYED IN CYLINDERS

0. FOREWORD

0.1 The manufacture of gas cylinders in India has achieved steady progress in the last few years. In order to guide the gas cylinder industry and users, a need was felt to compile the data on gases conveyed in cylinders.

0.2 In the preparation of this data sheet, assistance has been derived from the specifications and statutory regulations of the countries as given in Table 1.

0.3 In this data sheet, as far as practicable, the latest figures available from various sources have been included.

TABLE 1 LIST OF PUBLICATIONS

Sl No.	Country/Organization	Symbol*	Standard Publications
1	Australia	AU	AS : CB 4; AS : B 240†
2	Compressed Gas Association, USA	CGA	Compressed Gas Handbook
3	Czechoslovakia	CZ	CSN 078305
4	Denmark	D	DS† : 727.1 to 727.8
5	France	FR	PN†-E 29-651 to E 29-656
6	Germany (West)	G	German Compressed Gas Regulations; DIN 477 Blatt 1† and Blatt 3
7	Hungary	H	——
8	India	IN	Gas Cylinder Rules, 1940; IS : 2872; IS : 3224†, IS : 3710
9	Interstate Commerce Commission, USA	ICC	Tariff No. 13 ICC Regulations
10	Intergovernmental Maritime Consultative Organisation	IMCO	IMCO Dangerous Goods Code : Class 2 Compressed Gases
11	Ireland	IR	——
12	Israel	IS	SI : 607†, SI : 637
13	International Organization for Standardization	ISO	Doc. ISO/TC 58/SC 3 N 240; Doc. ISO/TC 58/SC 2 N 123† and N 130†
14	International Convention on the Carriage of Goods by Rail	RID	RID Regulations
15	Italy	IT	Italian Official Bulletin of the Inspectorate General of Authorized Motorization and Transport; UNI 4405† to 4412†
16	New Zealand	NZ	NZ : 696†
17	Norway	NO	——
18	Poland	PL	——
19	South Africa	SA	SABS 019
20	Sweden	SW	Swedish Gas Cylinder Code, SMS 2237†
21	United Kingdom	UK	UK Home Office Report of Gas Cylinders and Containers Committee; BS 341 : Part I†
22	United States of America	US	ASA : B 57.1†
23	Union of Soviet Socialist Republics (USSR)	R	Rules for the Construction and Safe Use of Pressure Vessels (Includes Cylinders)

*This symbol has been used in the data sheet to identify names of the countries from which the particulars have been obtained from their respective specifications or regulations.

†These publications cover the details of valve outlets only for gas cylinders.

1. SCOPE

1.1 This data sheet gives the technical data for 101 gases (list given in Appendix A) conveyed in cylinders. It lists chemical formula, physical state, toxicity values, flammability ranges, degree of corrosiveness, critical temperatures, boiling point, vapour pressure, etc, of gases. In addition to this, the sheet also gives the following technical data for **gas cylinders** used for conveying the gases :

> Service pressures, test pressures, filling pressures, filling ratio, type of valve outlets, list of prohibited materials, use of safety devices, and other specific characteristics, if any.

2. NOTES

2.1 In order to explain some of the columns in the data sheet, the following Notes have been included. The data sheet is to be read in conjunction with these Notes. **The number of Notes given below correspond to the numbers given within circles in the data sheet :**

1) These values are mostly taken from German Standard DIN 477 Blatt 3. However, wherever values from other specifications have been taken, it has been indicated by mentioning the symbol of the country to which the specification belongs.

2) *According to ICC Regulations* — Trichlorotrifluoroethane (R 113) is not classified as a liquefiable gas.

3) *According to Australian Standard AS : CB4* — These gases are classified as medium pressure liquefiable gases.

4) *According to German Compressed Gas Regulations*
   a) The weight of the solvent (acetone) should be at least 0·263 kg per litre of cylinder capacity.
   b) The filling pressure shall not exceed 18 kgf/cm^2 at 15°C. For higher and lower temperatures, the permissible pressure is determined according to the temperature-pressure curve of the solution referred to 18 kgf/cm^2 at 15°C.

Temperature °C	*Filling Pressure at* 15°C kgf/cm^2
0	13·0
5	14·6
10	16·3
15	18·0
20	19·7
25	21·6
30	23·6
35	25·7
40	28·0

5) *According to German Compressed Gas Regulations*
   a) Periodical inspection interval is 2 years for chlorine, hydrogen chloride, hydrogen sulphide, carbonyl chloride, nitrogen tetroxide, sulphurous acid, boron trifluoride, town gas and clearing gas. For vehicle tanks on rails, this period is increased to 3 years except for town gas. For town gas and clearing gas cylinders which are ultrasonically tested, the period is increased to 5 years.
   b) 5 years for all other permanent and liquefiable gases, dissolved ammonia and dissolved acetylene (counting from the date the porous mass is filled in). For vehicle tanks on rails, this period is increased to 6 years.
   c) 10 years for liquefied petroleum gases and hydrocarbons.
   d) 3 years for light metal containers, that come under special permission for carbon dioxide (carbonic acid), air, oxygen, nitrogen, hydrogen and rare gases.

According to RID Regulations — Periodical inspection interval is 2 years for all aluminium containers.

According to Russian Rules for Construction and Safe Use of Pressure Vessels and Gas Containers — The periodical inspection interval for all gases excepting corrosive gases is 5 years. For corrosive gases, it is to be 2 years.

According to Revised UK Home Office Report — Periodical inspection for low pressure liquefiable or LPG cylinders is as follows:

   a) Visual inspection interval — 5 years, and
   b) Hydraulic testing interval — 10 years, excepting that for corrosive gases it shall be 5 years.

According to Australian Gas Cylinder Code AS : CB4 — The periodical inspection period for all gas cylinders except those for LPG is 5 years, the value for LPG cylinders of water capacity more than 5·5 kg being 10 years. However, for cylinders over 40 years old or those cylinders which are fitted with shrunk on footrings, the periodical inspection period shall not exceed 2 years.

According to Gas Cylinder Rules, 1940 — Periodical inspection interval for cylinders used for corrosive gases is 2 years and for non-corrosive gases it is 5 years.

6) *According to Swedish Gas Cylinder Code* — The filling pressure at 15°C shall be:
   a) 250 kgf/cm^2 for following gases and gas mixtures :
      oxygen, nitrogen, helium, neon, argon, krypton, nitrox, $O_2 + CO_2$, inert gas mixtures, inert gas mixtures $+ O_2$, inert gas mixtures $+ N_2$.
   b) 200 kgf/cm^2 for all other permanent gases.

*According to Australian Gas Cylinder Code AS : CB*4 — The filling pressure for permanent gases shall be any of the following:

126·6 kgf/cm^2, 139·2 kgf/cm^2, and 253·1 kgf/cm^2.

7) *According to Swedish Gas Cylinder Code*
   a) For permanent gases the test pressure is 1·5 times the filling pressure but in no case less than 10 kgf/cm^2.
   b) For fluorine, the test pressure is 200 kgf/cm^2 and the filling pressure is 28 kgf/cm^2.

According to RID Regulations — The test pressure and filling ratio for containers for liquefiable gases fitted with heat insulation are different from those specified herein.

8) *According to Swedish Gas Cylinder Code* — This testing period of 10 years is only for cylinder up to 150 litres capacity. For higher capacities the testing period is 5 years.

9) *According to Australian Gas Cylinder Code AS : CB*4 — For commercial butane (which unlike normal butane is not a refrigerant gas) having vapour pressure (gauge) at 37·8°C of 14·76 kgf/cm^2, *Max*, the following values apply:

   Filling ratio = 0·49

   (According to Italian Ministry Regulation this is 0·46 for commercial butane),

   Service pressure = 8·65 kgf/cm^2,
   Test pressure = 17·58 kgf/cm^2.

10) *According to German Standard DIN* 477 *Blatt* 3 — The filling pressure value of 200 kgf/cm^2 is for inland transportation only. For international transportation as per RID Regulations, the value of 250 kgf/cm^2 is to be used.

11) *According to German Standard DIN* 477 *Blatt* 3 — This is a flammable gas (ignition range in air being specified in the respective column) although according to Swedish Gas Cylinder Code, it is not a flammable gas.

12) *According to Australian Gas Cylinders Code AS : CB*4 — The fitment of safety devices for cylinders having a diameter of 114 mm or less, and a water capacity of 3·6 kg or less, is *optional* (*O*).

13) *According to Swedish Gas Cylinder Code* — Carbon dioxide and nitrous oxide gas cylinders designed for a test pressure lower than 250 atm may be used within Sweden as well as in inter-European traffic according to RID regulations provided the filling weight is so adjusted that the internal gauge pressure in the cylinder does not exceed the test pressure of cylinder.

14) *According to ICC Regulations* — For carbon monoxide, the filling ratio shall be such that the pressure in the cylinder does not exceed 70·31 kgf/cm^2 at 70°F.

15) *According to Australian Gas Cylinder Code AS : CB*4 — For carbon dioxide cylinders which are used exclusively for fire fighting purposes, the period between tests shall not exceed 10 years for the first and second tests, and the interval between all subsequent tests shall not exceed 5 years; provided however, that should an extinguisher be discharged at any time exceeding two years after its previous test, the cylinder shall be retested prior to recharging and the interval between subsequent tests shall not exceed 5 years.

16) *According to Swedish Gas Cylinder Code* — For coal gas cylinders, in conjunction with the periodical inspection, the cylinders shall be subjected to an ultrasonic test to detect crack formation, if any.

17) *According to Swedish Gas Cylinder Code* — Refrigerant 12 gas forms poisonous gas on heating.

18) *According to RID Regulations and Czech Standard CSN* 078305 — The filling weight for fluorine is not to exceed 5 kg. However ICC Regulations stipulate a maximum filling weight of 2·7 kg for fluorine cylinders.

19) *According to German Standard DIN* 477 *Blatt* 3 — Hydrogen chloride is a high pressure liquefiable gas, the critical temperature being less than 70°C.

20) *According to Australian Gas Cylinder Code AS : CB*4 — The details covered in their specification are for commercial propane and pure propane having both vapour pressure (gauge) at 37·8°C of 14·77 kgf/cm^2 *Max* each.

21) *According to ICC Regulations* — All parts of valve and safety devices which are in contact with *contents* (vinyl methyl ether) of the cylinder must be of a metal or other material suitably treated if necessary, which will not cause formation of any acetylides.

22) *According to Italian Ministry Regulations* — The minimum test pressure value for pure propane is 26 kgf/cm^2 and for commercial propane it is 30 kgf/cm^2.

23) *According to RID Regulations* — The quality of solvent should be such that after absorbing the acetylene and increasing the temperature inside the container to 50°C, the pressure does not exeed 40 kgf/cm^2.

24) In some countries, ethylene is regarded as a permanent gas.

25) These values have been taken from the German Standard DIN 477 Blatt 3 and International Maritime Dangerous Goods Code: Class 2 Gases published by the International Maritime Consultative Organization (IMCO). Ignition range shows

whether, and within what range of concentration, the gas concerned is capable of forming mixtures with air in which at an initial temperature of 20°C and an initial pressure of 1 atm there is propagation of ignition, started by an ignition source.

26) These values have been taken from the German Standard DIN 477 Blatt 3. MAK figures give the maximum concentrations of health hazarding gases and vapours in the air at the working place, the values stated being those for which it can be assumed that no deleterious effect on health will normally occur even if exposure lasts daily for eight hours.

27) These service pressure values taken from the Australian Gas Cylinder Code AS : CB4 correspond to the values of the vapour pressure of the contents of an uninsulated cylinder at 65°C *Max* service temperature.

28) *According to German Compressed Gas Regulations* — The filling ratio for dissolved gases should be such that the container is filled with liquid to a maximum of 95 percent by volume at a filling temperature of 50°C.

29) ISO/R 817-1968 'Number designation of organic refrigerants', issued by the International Organization for Standardization, gives the refrigerant designation number of the various refrigerant gases, derived by a particular procedure based on the chemical composition of the refrigerant. This number is used along with the trade names of the gas, namely, Freon, Arcton, Alogofrene, Edifren, Frigen, etc, to describe the refrigerant gases. However, the list of gases covered in this chart does not include many of the refrigerant gases, which are not so common in use. For a comprehensive list of refrigerant gases, their chemical formulae, refrigerant numbers, molecular mass and type of valve outlets, *see* Note 35. For a summary of the data on standard refrigerant gas mixtures used in various countries, *see* Note 36.

30) The information about the safety devices has been mostly taken from the Australian Gas Cylinder Code AS : CB4. If information from any other source is obtained, the same is indicated by mentioning the symbol of the country to which the document giving such information belongs.

31) The classification of gases for valve outlets has been based on Doc : ISO/TC 58/SC 2 (Secretariat 56) 118 'List of arrangements, standardized or in use, for valve outlets for gas cylinders' prepared by International Organization for Standardization. The purpose is to divide the gases into suitable categories for which the same type of valve outlets can be used and thus systematically prevent proliferation of valve outlets. The gases have therefore been divided into 4 main groups (that is A, B, C and D) and then suitable sub-groups (I, II, III and IV) to indicate the valve outlet category, as given in Table 2. *It should be possible to use the same type of valve outlet for all gases belonging to the same main group and sub-group*; for example, all flammable low pressure liquefiable gases have been put in Category A II.

TABLE 2 CATEGORY OF GASES FOR VALVE OUTLETS

SUB-GROUP	MAIN GROUP			
	Group A	Group B	Group C	Group D
	Flammable gases	Fuel, oxidizing and combustion assisting gases	Neutral, inert gases	Toxic, harmful poisonous gases
I	Dissolved gas acetylene	Air	Gases other than rare and inert refrigerants	Flammable gases
II	Low pressure liquefiable gases	Oxygen	Rare gases	Highly reactive, corrosive or oxidizing gases having serious fire risk
III	High pressure liquefiable or permanent gases	Nitrous oxide	Refrigerant gases	Gases with low flammability risk
IV	—	—	—	Other toxic gases

The sub-group category of the gases, type of valve outlet and symbol of countries using that type of valve outlet have been indicated under the column of main group. The symbols used in describing the valve outlet are as follows:

INT — Internal (that is Female),
EXT — External (that is Male),
BSP — British Standard pipe thread,
W — British Standard Whiteworth thread,
SI — System International thread (that is ISO thread), and
NGO — National Gas Outlet threads, USA

LH and RH refer to left and right-hand threads respectively

32) For the degree of flammability of flammable gases, *see* col 17 and 23 of data sheet which give the ignition range (explosive limit) in air, percentage by volume.

33) For the degree of toxicity, *see* col 18 and 23 of data sheet which give the toxicity values of the toxic gases. It may, however, be mentioned that for the purpose of valve outlet classification, certain gases like vinyl methyl ether, vinyl bromide which have been listed toxic under this column, have not been included in Category D (Toxic Gases) as the degree of toxicity is too small to justify for inclusion under Category D.

34) *Gas Classification According to Compressed Gas Association, USA* — The following four properties of the gases have been described by a four-digit code :

a) Flammability,
b) Toxicity,
c) Corrosivity, and
d) State of gases.

Each of these properties has been described by a digit given below:

a) *First Digit — Flammability Limit in Air (by Volume)*

0 = inert
1 = flammable (< 13 percent lower limit or > 12 percent flammability range)
2 = supports combustion (oxidizing)
3 = pyrophoric
4 = highly oxidizing
5 = subject to decomposition or polymerization, also flammable

[*References* — Coward (H F) and Jones (G W). Limits of flammability of gases and vapours. Bureau of Mines Bulletin. 503; 1952; 130-33.

Matheson Gas Data Book. Ed 4. 1966.]

b) *Second Digit — Toxicity*

0 = non-toxic : over 500 ppm permitted
1 = toxic : 50 to 500 ppm permitted (or very toxic with good warning properties)
2 = very toxic : less than 500 ppm permitted

These are threshold limit values (concentration in air to which nearly all workers may be exposed day after day, without adverse effects), as recommended by the 1968 American Conference of Governmental Industrial Hygienists, 30th annual meeting, St. Louis, Missouri, May 13, 1968. Those gases which are not listed, and which are considered non-toxic, are presumed to have a threshold limit value of over 500 ppm.

c) *Third Digit — Corrosivity*

0 = non-corrosive
1 = non-halogen acid forming
2 = basic
3 = halogen acid forming

[*References* — Matheson Gas Data Book. Ed 4. 1966; Handbook of Compressed Gases. 1966. Compressed Gas Association, New York, N.Y. Reinhold Publishing Corporation, New York, N.Y.; Perry's Chemical Engineers Handbook. Ed 4. edited by R.H. Perry, C.H. Chilton and S.D. Kirkpatrick, McGraw-Hill Book Company, New York, N.Y., 1963, P *23*-8 to *23*-30.]

Metals are considered as suitable = *S*; unsuitable = *U*; and not recommended = *NR*. The following metals were considered:

aluminium (Al), brass (Br), copper (Cu), steel (St), stainless steel (SS), monel (M).

d) *Fourth Digit — State of Gas*

0 = liquefiable gas — less than 35·15 kgf/cm^2 gauge pressure at 70°F
1 = liquefiable gas — over 35·15 kgf/cm^2 gauge pressure at 70°F
2 = permanent gas — less than 35·15 kgf/cm^2 cylinder pressure
3 = permanent gas — between 35·15 and 210·9 kgf/cm^2 cylinder pressure
4 = permanent gas — between 211·0 and 421·8 kgf/cm^2 cylinder pressure
5 = permanent gas — between 421·9 and 703·1 kgf/cm^2 cylinder pressure
6 = permanent gas — between 703·2 and 703·1 kgf/cm^2 cylinder pressure
7 = liquefiable gas (optional) — liquid withdrawal
8 = cryogenic gas (optional) — liquid withdrawal
9 = dissolved gas

(*Reference* — Matheson Gas Data Book, Ed 4. 1966)

Example:

In the data sheet in col 23 the classification of carbon monoxide gas has been described by the Code 1203 which, according to the above explanations, means:

Flammability 1 — It is flammable (< 13 percent lower limit > 12 percent flammability range)
Toxicity 2 — It is very toxic : less than 500 ppm permitted
Corrosivity 0 — It is a non-corrosive
State of gas 3 — It is a permanent gas and full cylinder pressure is between 35·15 and 210·9 kgf/cm²

35) *Organic Refrigerant Nomenclature* — According to ISO/R 817-1968 'Number designation of organic refrigerant' — *See* Table 3.

TABLE 3 ORGANIC REFRIGERANT NOMENCLATURE

Refrigerant Numbering Designation	Chemical Name*	Chemical Formula*	Valve Outlet Category According to ISO Classification	Molecular Mass	CGA Classification Code (*See* Note 34)
		Halocarbon Compounds			
10	Carbontetrachloride	CCl_4	—	153·8	—
11	Trichloro (mono) fluoromethane†	CCl_3F	C III	137·4	0000
12	Dichlorodifluoromethane	CCl_2F_2	C III	120·9	0000
12B	(Mono) chloro (mono) bromo-difluoromethane†	$CClF_2Br$	C III	—	0000
13	(Mono) bromotrifluoromethane†	$CClF_3$	C III	104·5	0000
13B1	(Mono) bromotrifluoromethane†	$CBrF_3$	C III	148·9	0000
14	Carbontetrafluoride	CF_4	C III	88·0	0003
20	Chloroform	$CHCl_3$	—	119·4	—
21	Dichloromonofluoromethane	$CHCl_2F$	C III	102·9	0000
22	Monochlorodifluoromethane	$CHClF_2$	C III	86·5	0000
23	Trifluoromethane	CHF_3	C III	70·0	0001
30	Methylene chloride	CH_2Cl_2	—	84·9	—
31	Monochloromonofluoromethane	CH_2ClF	C III	68·5	—
32	Methylene fluoride	CH_2F_2	—	52·0	0001
40	Methyl chloride	CH_3Cl	D I	50·5	1100
41	Methyl fluoride	CH_3F	A II	34·0	1001
50	Methane‡	CH_4	A III	16·0	1003
110	Hexachloroethane	CCl_3CCl_3	—	236·8	—
111	Pentachloro (mono) fluoroethane†	CCl_3CCl_2F	C III	220·3	0000

*This proposal is based on the systems used in the United States of America by CHEMICAL ABSTRACTS.

†The use of *mono*, where enclosed by parentheses, is optional, since only one compound is possible based on the chemical name or formula.

‡The compounds methane, ethane, and propane appear in the halocarbon section in their proper numerical positions, although these products are not halocarbons.

(*Continued*)

TABLE 3 ORGANIC REFRIGERANT NOMENCLATURE — *Contd*

Refrigerant Numbering Designation	Chemical Name*	Chemical Formula*	Valve Outlet Category According to ISO Classification	Molecular Mass	CGA Classification Code (*See* Note 34)
112	1,1,2,2-Tetrachlorodifluoroethane	CCl_2FCCl_2F	C III	203·8	0000
112a	1,1,1,2-Tetrachlorodifluoroethane	CCl_3CClF_2	C III	203·8	0000
113	1,1,2-Trichlorotrifluoroethane	CCl_2FCClF_2	C III	187·4	0000
113a	1,1,1-Trichlorotrifluoroethane	CCl_3CF_3	C III	187·4	0000
114	1,2-Dichlorotetrafluoroethane	$CClF_2CClF_2$	C III	170·9	0000
114a	1,1-Dichlorotetrafluoroethane	CCl_2FCF_3	C III	170·9	0000
114B2	1,2-Dibromotetrafluoroethane	$CBrF_2CBrF_2$	C III	259·9	0000
115	(Mono) chloropentafluoroethane†	$CClF_2CF_3$	C III	154·5	0000
116	Hexafluoroethane	CF_3CF_3	C III	138·0	0000
120	Pentachloroethane	$CHCl_2CCl_3$	—	202·3	—
123	2,2-Dichloro-1,1,1-Trifluoroethane	$CHCl_2CF_3$	C III	153	0000
124	2-Chloro-1,1,1,2-Tetrafluoroethane	$CHClFCF_3$	C III	136·5	0000
124a	1-Chloro-1,1,2,2-Tetrafluoroethane	CHF_2CClF_2	C III	136·5	0000
125	Pentafluoroethane	CHF_2CF_3	C III	120	0000
133a	2-Chloro-1,1,1-Trifluoroethane	CH_2ClCF_3	C III	118·5	0000
140a	1,1,1-Trichloroethane	CH_3CCl_3	—	133·4	—
142b	1-Chloro-1,1-difluoroethane	CH_3CClF_2	A II	100·5	1000
143a	1,1,1-Trifluoroethane	CH_3CF_3	C III	84	0000
150a	1,1-Dichroethane	CH_3CHCl_2	—	98·9	—
152a	1,1-Difluoroethane	CH_3CHF_2	A II	66	1000
160	Ethyl chloride (chloroethane)	CH_3CH_2Cl	A II	64·5	1000
170	Ethane‡	CH_3CH_3	A III	30	1001
218	Octafluoropropane	$CF_3CF_2CF_3$	C III	188	—
290	Propane‡	$CH_3CH_2CH_3$	A III	44	1000
	Cyclic Organic Compounds				
C316	1,2-Dichlorohexafluorocyclobutane	$C_4Cl_2F_6$	C III	233	0000

*This proposal is based on the systems used in the United States of America by CHEMICAL ABSTRACTS.

†The use of *mono*, where enclosed by parentheses, is optional, since only one compound is possible based on the chemical name or formula.

‡The compounds methane, ethane, and propane appear in the halocarbon section in their proper numerical positions, although these products are not halocarbons.

(*Continued*)

TABLE 3 ORGANIC REFRIGERANT NOMENCLATURE — *Contd*

REFRIGERANT NUMBERING DESIGNATION	CHEMICAL NAME*	CHEMICAL FORMULA*	VALVE OUTLET CATEGORY ACCORDING TO ISO CLASSIFICATION	MOLECULAR MASS	CGA CLASSIFICATION CODE (*See* NOTE 34)
C317	(Mono) chloroheptafluorocyclobutane†	C_4ClF_7	C III	216·5	0000
C318	Octafluorocyclobutane	C_4F_8	C III	200	0000
Azeotropic Mixtures					
500	Refrigerants 12/152a-73·8/26·2 percent by weight	CCl_2F_2/CH_3CHF_2	C III	99·29	—
501	Refrigerants 22/12-75/25 percent by weight	$CHClF_2/CCl_2F_2$	C III	93·1	—
502	Refrigerants 22/115-48·8/51·2 percent by weight	$CHClF_2/CClF_2CF_3$	C III	112	—
Hydrocarbons					
50	Methane	CH_4	A III	16·0	1003
170	Ethane	CH_3CH_3	A III	30	1000
290	Propane	$CH_3CH_2CH_2CH_3$	A III	44	1000
600	n-Butane	$CH_3CH_2CH_3$	A II	58·1	1000
600a	Isobutane (2-Methyl Propane)	$CH(CH_3)_3$	A II	58·1	1000
1150	Ethylene‡	$CH_2{=}CH_2$	A III	28·0	1003
1270	Propylene‡	$CH_3CH{=}CH_2$	A II	42·1	1000
Unsaturated Organic Compounds					
1112a	1,1-Dichlorodifluoroethylene	$CCl_2{=}CF_2$	C III	133	0000
1113	(Mono) chlorotrifluoroethylene†	$CClF{=}CF_2$	C III	116·5	5100
1114	Tetrafluoroethylene	$CF_2{=}CF_2$	C III	100	5000
1120	Trichloroethylene	$CHCl{=}CCl_2$	—	131·4	—
1130	1,2-Dichloroethylene	$CHCl{=}CHCl$	—	96·9	—
1132a	1,1-Difluoroethylene (vinylidenefluoride)	$CH_2{=}CF_2$	A II	64	1001
1140	Vinyl chloride	$CH_2{=}CHCl$	C III	62·5	5100
1141	Vinyl fluoride	$CH_2{=}CHF$	C III	46	5100
1150	Ethylene‡	$CH_2{=}CH_2$	A III	28·0	1003
1270	Propylene‡	$CH_3CH{=}CH_2$	A II	42·1	1000

*This proposal is based on the systems used in the United States of America by CHEMICAL ABSTRACTS.

†The use of *mono* ,where enclosed by parentheses, is optional, since only one compound is possible based on the chemical name or formula.

‡The compounds methane, ethane, and propane appear in the halocarbon section in their proper numerical positions, although these products are not halocarbons.

From Table 3 it can be seen that the valve outlet categories for refrigerant gases fall under the following heads:

a) *Category A II* (*Flammable Gases*) — This is for all *low pressure liquefiable* refrigerant gases which are flammable by nature. However this excludes methyl chloride which though being a low pressure liquefiable flammable gas has been categorized under D1 as it is a toxic gas. Also the more commonly used refrigerant gases belonging to this category have right-hand threads and not the conventional left-hand threads associated with flammable gases.

b) *Category A III* (*Flammable Gases*) — This is for *high pressure liquefiable* refrigerant gases which are flammable by nature, such as methane, ethane, propane and ethylene.

c) *Category C III* (*Neutral Gases*) — This is for all refrigerant gases, which are non-flammable, that is, neutral by nature. There are only three types of valve outlets which are in current use in various countries for any of the refrigerant gases belonging to Category C III as detailed below:

   1) EXT-BSP 5/8×1/14 RH — India (outlet No. 5 of IS : 3224-1971), United Kingdom, Sweden and New Zealand.

   2) EXT-W 21·8 × 1·814 RH — Germany, Italy, Israel and Poland.

   3) EXT-NGO 1·030×1/14 RH — France and New Zealand.

d) *Category D I* (*Toxic Gases*) — This is for refrigerant gases which are both toxic and flammable by nature. Methyl chloride comes under this category.

36) Refrigerant Gas Mixture — *See* Table 4.

37) Liquefied Petroleum Gas Mixture (LPG) — *See* Table 5.

38) These gases have been covered in more details in Compressed Gas Handbook published by Compressed Gas Association, USA. The following additional data has been given in the handbook:

   a) Physical constants (for example, molecular weight, specific gravity, specific volume, specific heat, critical pressure, etc);

   b) Manufacture of gas;

   c) Commercial applications;

   d) Materials of constructions of cylinders;

   e) Physiological effects;

   f) Details of cylinders and containers used in USA; and

   g) Shipping methods.

TABLE 4 REFRIGERANT GAS MIXTURES

(*See also* Note 29)

DESIGNATION ACCORDING TO RID REGULATIONS, SWEDISH CODE AND ITALIAN OFFICIAL BULLETIN	HIGHEST VAPOUR PRESSURE AT 70°C, kgf/cm² abs	MINIMUM DENSITY AT 50°C, kg/l	FILLING RATIO*	INSPECTION INTERVAL, YEARS	TEST PRESSURE, kgf/cm² GAUGE
Gas Mixture F_1	13 — G, IT, SW	1·30 — G, IT, SW	1·23 — SW, IT, CZ	5 — SW, CZ	12 — G, SW, IT, CZ
Gas Mixture F_2	19 — G, IT, SW	1·21 — G, IT, SW	1·15 — SW, IT, CZ	5 — SW, CZ	18 — G, SW, IT, CZ
Gas Mixture F_3	30 — G, IT, SW	1·09 — G, IT, SW	1·03 — SW, IT, CZ	5 — SW, CZ	29 — G, SW, IT, CZ

Symbols for Countries :

G — German Standard DIN 477 Blatt 3
CZ — Czech Standard CSN 078305
RID — International Convention on the Carriage of Goods by Rail
IT — Italian Official Bulletin of the Inspectorate General of Authorized Civil Motorization and Transports
SW — Swedish Gas Cylinder Code

*According to ICC Regulations the filling ratio should be such that the liquid portion of the gas does not completely fill the cylinder at 130°F.

TABLE 5 LIQUEFIED PETROLEUM GAS MIXTURE (LPG)

DESCRIPTION ACCORDING TO RID REGULATIONS	HIGHEST VAPOUR PRESSURE AT 70°C, kgf/cm²	MINIMUM DENSITY AT 50°C, kg/l	FILLING RATIO	TEST PRESSURE, kgf/cm²	INSPECTION INTERVAL YEARS	DESCRIPTION ACCORDING TO PRESSURE VESSEL COMMISSION'S CISTERN STANDARDS III*	INTERNATIONAL TRADE NAME
Gas Mixture A	11 — SW, IT, G	0·525 — SW, IT, G	0·50 — SW, IT, G, CZ	10 — SW, IT, G, CZ	10† — SW, G 5 — CZ	Gasol-Butane	Butane
Gas Mixture A_0	16 — SW, IT, G	0·495 — SW, IT, G	0·47 — SW, IT, G, CZ	15 — SW, IT, G, CZ	10† — SW, G 5 — CZ	Gasol 7	Butane
Gas Mixture A_1	21 — SW, IT, G	0·485 — SW, IT, G	0·46 — SW, IT, G, CZ	20 — SW, IT, G, CZ	10† — SW, G 5 — CZ	Gasol 10	—
Gas Mixture B	26 — SW, IT, G	0·450 — SW, IT, G	0·43 — SW, IT, G, CZ	25 — SW, IT, G, CZ	10† — SW, G 5 — CZ	Gasol-propane	—
Gas Mixture C	31 — SW, IT, G	0·440 — SW, IT, G	0·42 — SW, IT, G, CZ	30 — SW, IT, G, CZ	10† — SW, G 5 — CZ	Gasol-propane	Propane

Symbol for Countries:

SW — Swedish Gas Cylinder Code
IT — Italian Official Bulletin of the Inspectorate General of Authorized Civil Motorization and Transport
CZ — Czech Standard CSN 078305
G — German Standard DIN 477 Blatt 3
RID — International Convention on the Carriage of Goods by Rail

*Gasol 7 means vapour pressure of the LPG mixture at 40°C is 7 atm.

†According to Swedish Gas Cylinder Code, it applies only to cylinders having a capacity not exceeding 150 litres. For cylinders of greater capacity, the interval should be 5 years.

APPENDIX A

(*Clause* 1.1)

LIST OF GASES

1. Acetylene, dissolved
2. Air, compressed
3. Ammonia, anhydrous
4. Ammonia, dissolved
5. Argon
6. Boron trifluoride (Boron fluoride)
7. Butadiene (vinylethylene, divinyl)
8. Butane (normal)
9. Butene
10. Carbogen
11. Carbon dioxide (carbonic acid)
12. Carbon monoxide
13. Carbonyl sulphide
14. Cartox [T-gas (250)]
15. Chlorine
16. Chlorine pentafluoride
17. Chlorine trifluoride
18. Chloropropene
19. Coal gas (town gas, lighting gas)
20. Cyanogen
21. Cyanogen chloride (chlorine cyanide)
22. Cyclobutane
23. Cyclopropane
24. Deuterium (heavy hydrogen)
25. Diborane (boroethane)
26. Dichlorodifluoromethane (12)
27. Dichloromonofluoromethane (21)
28. 1·2-Dichlorotetrafluoroethane (114)
29. 1·1-Difluoroethane (ethylidene fluoride) (152 a)
30. 1·1-Difluoroethylene (vinylidene fluoride) (1132 a)
31. Dimethylamine
32. Dimethyl ether (methyl ether, methyl oxide)

33. Dimethyl propane
34. Ethane
35. Ethylamine (aminoethane)
36. Ethylchloride (chloroethane)
37. Ethylene
38. Ethylene oxide (1·2 epoxyethane, oxirane)
39. Fluorine
40. Helium
41. Hexafluoropropylene
42. Hydrogen
43. Hydrogen bromide, anhydrous
44. Hydrogen chloride, anhydrous
45. Hydrogen cyanide, anhydrous
46. Hydrogen fluoride, anhydrous
47. Hydrogen sulphide
48. Isobutane (2-methyl propane)
49. Isobutylene
50. Krypton
51. Methane (coal damp gas, natural gas)
52. Methanethiol (methylmercaptan)
53. Methyl acetylene
54. Methylamine (aminomethane)
55. Methyl bromide (bromomethane)
56. Methyl chloride (chloromethane)
57. Methyl fluoride
58. Methyl ethyl ether (methyl ethyl oxide, methoxyethane)
59. Monochlorodifluoroethane (142 b)
60. Monobromotrifluoromethane (13 B_1)
61. Monochlorodifluoromethane (22)
62. Monochloromonobromodifluoromethane (12 B_1)
63. Monochlorotetrafluoroethane (124 a)
64. Monochlorotrifluoroethane (133 a)
65. Monochlorotrifluoroethylene (1113)
66. Monochlorotrifluoromethane (13)
67. Neon
68. Nitric oxide
69. Nitrous oxide
70. Nitrogen
71. Nitrogen peroxide (nitrogen dioxide, nitrogen tetraoxide, dinitrogen tetraoxide)
72. Nitrosyl chloride
73. Nitrox
74. Octafluorocyclobutane
75. Oil gas, compressed
76. Oil gas, liquefied (Z gas)
77. Oxygen
78. Ozone
79. Phosgene (carbonyl chloride)
80. Propane
81. Propene
82. Rare gas mixture (He, Ne, Ar, Kr)
83. Rare gas mixture (As above + N_2)
84. Rare gas mixture (As above + O_2)
85. Silicon tetrafluoride
86. Sulphur dioxide (sulphurous acid)
87. Sulphur hexafluoride
88. T-gas (28)
89. Tetrafluoroethylene (1114)
90. Trichlorofluoromethane (11)
91. 1.1.2 Trichlorotrifluoroethane (113)
92. Trifluoromethane
93. Trifluoromonobromomethane
94. Trimethylamine
95. Vinyl bromide
96. Vinyl chloride
97. Vinyl fluoride
98. Vinyl methyl ether (methyl vinyl ether, methyl vinyl oxide)
99. Volcanic gas
100. Water gas
101. Xenon

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1	2	3	4	5	6	7	8	9	10	11	12	13	14		15		16		17	18	19	20		21		22	23					
1	Acetylene, dissolved ⑮④		C_2H_2	D	Yes	No	No	+36·3	−84 sublimated		$\boxed{A}\boxed{I}$ INT-BSP $\frac{3}{4}$ RH—IN, O, G, NO, SW INT-BSP $\frac{5}{8}$ LH—IN, IR, AU, FR, UK, NZ, SA	1 and 2			60	RIO, G, CZ, IT	5	G, CZ	1·5 to 82 (G) 2·1 to 30 (IMCO)		Natural rubber, copper	0·1575	G ⑬	15 17·58 15·82	RIO, G ICC (at 70°F) AU	IMCO – Empty cylinders to be carried with the same precautions as filled cylinders.	1 2·5-81%	0 Over 500 ppm	0 Br, (<65% Cu), St, SS, M	Br (>65% Cu), Cu	Al	4 17·58
2	Air, compressed ⑳			P	No	No	No	−141		0	$\boxed{B}\boxed{I}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—IN, AU, CZ, G, IR, UK, NO, NZ, PL, SW, SA	3			1·5p	SW, R, G	5	SW, RIO, G	None (IMCO)					200 250	RIO, G SW, G ⑲	IMCO – Carriage in high pressure cylinders.	2	0	0	All metals		3 154·7
	Aminoethane	See Ethylamine																														
	Aminomethane	See Methylamine																														
3	Ammonia (Anhydrous) ⑱	717	NH_3	LL	No ③	Yes	No	+132·4	−33·4	0	$\boxed{D}\boxed{III}$ EXT-BSP $\frac{1}{2} \times \frac{1}{14}$ RH—IN, AU, UK, R, SA EXT-W 21·8 × 1·814 RH—G, H, IS, PL, SW, O	9	29·04 28·83	IND AU	33 36·56 30	SW, G, CZ, IT AU R, RIO	5	CZ, SW, RIO, G, AU	15 to 28 (G) 15 to 30 (IMCO)	110 ppm	Copper and copper alloys	0·53 0·51 0·54	CZ, SW, AU, RIO, IT IN, UK ICC				0 16-25%	1 50 ppm	2 SS, St, M, Al	Br, Cu		0 8·02
4	Ammonia dissolved in water i) 35%-40% by vol ii) 40%-50% by vol			D	No	No	No	—							i) 10 ii) 12	G, SW, R, RIO, IT G, SW, R, RIO, IT	i) 5 ii) 5	SW, CZ, RIO SW, CZ, RIO	Not applicable (IMCO)		Copper and copper alloys	i) 0·60 ii) 0·77	IT, SW, G, RIO ⑲			IT – Transport not allowed where NH_3 is more than 50% by volume in solution. IMCO – Extremely dangerous to eyes in the liquid state. Suffocating in low concentrations.						
5	Argon ⑳		Ar	P	No	No	No	−185·9	−122·4	0	$\boxed{C}\boxed{II}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—IN, AU, UK, NZ, SA	3			1·5p	SW, G, R, CZ	5	SW, RIO, CZ	None (IMCO)			1·15	ICC	250 200	SW, CZ, G RIO, G, CZ ⑲		0	0 Over 500 ppm	0 All metals			3 154·7
	Boroethane	See Diborane																														
6	Boron trifluoride (Boron fluoride) ⑳		BF_3	P	No	Yes	Yes	−12·3	1·99		$\boxed{D}\boxed{IV}$ EXT-W 25·4 × 3·175 RH—CZ, G, IT, NO, H, SW, PL				1·5p	SW, G, CZ, R	2	G, SW, RIO, CZ			Copper and its alloys			200	RIO, G, SW, CZ	IMCO – Forms dense white corrosive fumes in moist air. Reacts violently with many substances.	0	1 1 ppm	3 M	Al	St Br, Cu	3 154·7
	Bromomethane	See Methyl bromide																														
7	Butadiene (Vinylethylene, Divinyl) ㉘		C_4H_6	LL	Yes	No	No	+152	−4·4	R	$\boxed{A}\boxed{II}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—IN, UK, AU EXT-W 21·8 × 1·814 LH—CZ, D, G, PL, H	4	7·31 7·38	IND AU	10 17·58	SW, IT, RIO, CZ, G AU	10 5	SW CZ, RIO ⑨	1·1 to 12·5 2·0 to 44	1000 ppm		0·50 0·55	IN, AU, UK CZ, G, SW, IT, RIO				5 2-11·5%	0 1000 ppm	0 All metals			0 1·55
8	Butane (Normal) ㉟⑨	600	C_4H_{10}	LL	Yes	No	No	+152	−0·5	R	$\boxed{A}\boxed{II}$ EXT-SI 21·8 × 1·814 LH—IN, UK, R, FR EXT-W 21·8 × 1·814 LH—IN, CZ, IR, SA, PL, NZ, D	8	6·26 6·33	IND AU	10 12 17·58	SW, IT, RIO, CZ G, R AU	10 5	SW CZ, RIO ⑨	2·2 to 8·5			0·50 0·51 0·52 0·438	IN, UK AU, G, IT, CZ RIO R				1 1·9-8·5%	0 Over 500 ppm	0 All metals			0 1·12
9	Butene ㉘		C_4H_8	LL	Yes	No	No	+146·4	−6·3		$\boxed{A}\boxed{II}$ DITTO				10	SW, IT, RIO, R, G, CZ	5 10	CZ, RIO SW ⑨	1·6 to 9·3			0·52 0·53 0·526	IT, SW, G, CZ RIO R				1 1·6-9·3%	0	3 All metals			0 1·62
10	Carbogen ⑳ O_2 = 95% by vol CO_2 = 5% by vol		$O_2 + CO_2$	P	No										1·5p	G					Steel, oil and grease			200 250	G G ⑲							
11	Carbon dioxide (Carbonic acid) ㉙	744	CO_2	HL	No	No	No	+31·0 (G) +31·1 (IN)		⑰ R	$\boxed{C}\boxed{I}$ EXT-W 21·8 × 1·814 RH—IN, AU, P, G, IR, IS, SW, SA, UK, H, IT, NO, PL EXT-BSP $\frac{3}{4} \times \frac{1}{14}$ RH—CZ, R	7	191·6	AU	250 210·9	RIO, SW, IT AU ⑬	5 10	RIO, SW AU ⑳	None (IMC			0·667 0·68 0·75	IN, UK, AU ICC SW, IT, RIO, R ⑭				0	0 5000 ppm	0 All metals if dry			0 58·36

Note—Numbers within circles refer to note numbers given in clause 2.1.

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12	Carbon monoxide ⑯		CO	P	⑧ NO	Yes	No	−139	−191·5	P	D I INT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH—IN, AU, UK EXT-W 21·8 x 1·814 LH—N, NO, PL, D	4			1·5p 210·9	RIO, G, R AU			12·5 to 74 (G) 12 to 75 (IMCO)	100 ppm				200 70·31	G, RIO AU	CBA—Considered very toxic because it lacks odour. SW—Not to be transported in welded cylinders.	1 12·5–74%	2 50 ppm	0 All metals except steel	St		3 105·5
	Carbonyl chloride	See Phosgene																														
13	Carbonyl sulphide		COS	P	Yes	Yes					D I													200	RIO		1 11·9–28·5%	2 15 ppm	1 All metals if dry. SS, Al if wet		Other metals	0 11·25
14	Cartox (T Gas (250))		CO_2 = 90% by wt C_2H_4O = 10% by wt	HL	No	Yes									250	G, IT			31 to 52·3 (G)			0·75	G, IT									
15	Chlorine ⑯		Cl_2	③ LL	No	Yes	Yes (IMCO)	+144	−34	P	D IV EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH—UK, IN EXT-W 25·4 x 3·175 RH—CZ, D, SW, G, FR, N, NO, P, IT	5	19·98 20·63	IN AU	22 30 25·31	RIO, G, SW, IT R AU	2	G, SW, RIO, R	0·6		Zinc alloys, tin, spelter waxes, oils and greases	1·19 1·25	IN, UK SW, R, RIO, G, IT, ICC, AU			IMCO—Corrosive in the presence of moisture. Oxidising agent.	2	1 1 ppm	3 Ag, Tin, Zr, M, Hastalloy C		Other metals	0 5·98
	Chlorine cyanide	See Cyanogen chloride																														
16	Chlorine pentafluoride		ClF_5																							CBA—Ignites wood on contact. Reacts with water.	4	1 0·1 ppm	3 M, Al		Br, Cu, St, SS (ok if dry)	0 <35·15
17	Chlorine trifluoride		ClF_3	LL		Yes	Yes				D II EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH—IN, UK	5	4·38	IN								1·59	IN, UK			CBA—Ignites wood on contact. Reacts with water	4	1 0·1 ppm	3 M, Al		Br, Cu, St, SS (ok if dry)	0 0·47
	Chloroethane	See Ethyl chloride																														
	Chloromethane	See Methyl chloride																														
18	Chloropropane		C_3H_5Cl	LL	Yes						A II																1 4·8–16%	0 Over 500 ppm	0 All metals			0 <35·15 (liquid)
	Coal Damp Gas	See Methane																														
19	Coal gas (town gas, lighting gas)		$H_2 + CO + CH_4$	P	Yes	Yes	No				D I INT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH—IN, UK, AU EXT-W 21·8 x 1·814 LH—PL, SW, D	4			1·5p	SW, G, RIO, R	2	⑩ SW, RIO, G	4·5 to 40 (G) 4·5 to 40 (IMCO)					200	RIO, SW, G	SW—Before being filled with any other gas, cylinders shall be burnt out, but shall never be used for oxygen.						
20	Cyanogen		$(CN)_2$	LL	Yes	Yes	No				D I EXT-W 25·4 x 3·175 RH—CZ, PL		15·17	IN					6·6 to 4·3 (IMCO)			0·72	IN, UK				1 6–32%	2 10 ppm	0 SS, M, Br and probably others			0 4·22
21	Cyanogen chloride (Chlorine cyanide)		ClCN	LL	No	Yes	Yes		+12·9				4·99	IN	20	G			None (IMCO)			0·96 1·07	IN, UK G			IMCO—On contact with water or steam, reacts violently to give off highly toxic and corrosive fumes.	0	2 0·5 ppm	3 All metals if dry, otherwise M			0 1·78

Note—Numbers within circles refer to note numbers given in clause 2.1.

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22	Cyclobutane		C_4H_8																													
23	Cyclopropane ⑭		C_3H_6	LL	Yes	No	No	+ 125	−32·8	⑧ R	$\boxed{A}\boxed{II}$		19·12 18·63	IN AU	25 23·20	SW, G, IT, RIO, CZ AU	5 10	CZ, RIO ⑧ SW	2·4 to 10·4 (G)	400 ppm	–	0·48 0·53 0·65 0·51	IN, UK, AU SW, CZ, G, IT ICC RIO				1 2·4 – 10·4 %	0 Over 500 ppm	0 All metals			0 5·27
24	Deuterium (Heavy Hydrogen)		D_2		Yes	No	No				$\boxed{A}\boxed{III}$ EXT-W 21·8 x 1·814 LH — H, PL, G EXT-SI 21·8 x 1·814 LH — FR								5 to 80 (IMCO)							IMCO — Carried in high pressure cylinders.	1 4 – 75 %	0 Over 500 ppm	0 All metals			3 140·6
25	Diborane (Boroethane)		B_2H_6	LL	Yes	Yes					$\boxed{D}\boxed{I}$ EXT-W 25·4 x 3·175 RH — CZ, PL								0·9 to 98 (IMCO)		Rubber					IMCO – Similar to phosgene in toxicity, corrodes rubber.	3 0·9 – 98 %	2 0·1 ppm	0 All metals			3 42·48
26	Dichlorodifluoromethane ⑭	12	CCl_2F_2	LL	No	⑪ No	No	+111·8	− 29·8	R	$\boxed{C}\boxed{III}$ EXT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ RH – IN, UK, NZ, SW EXT-W 21·8 x 1·814 RH – G, IT, IS, PL EXT-NGO 1·030 x 1/14 RH – FR, NZ	5	16·17 18·17	IN AU	15 30 21·08	SW, G, RIO, IT, CZ R AU	5	SW, CZ, RIO	None (IMCO)	1000 ppm		1·08 1·15 1·10 1·12	IN, UK CZ, AU, G, IT SW, R RIO				0	0 1000 ppm	0 All metals			0 4·82
27	Dichloromonofluoromethane	21	$CHCl_2F$	LL	No	No	No	+178·5	+ 8·9	R	D I T T O	5	4·40 3·27	IN AU	12 16 17·58	CZ, SW, RIO, IT G AU	5	CZ, RIO, SW	None (IMCO)	1000 ppm		1·20 1·23 1·18 1·05	IN, UK SW, IT, CZ, G AU RIO				0	0 1000 ppm	0 All metals			0 0·88
28	1-2- Dichlorotetrafluoroethane	114	$CClF_2CClF_2$	LL	No	No	No	+ 146	+ 3·8	R	D I T T O		5·67 5·88	IN AU	10 17·58	SW, G, RIO, IN, CZ AU	5	CZ, RIO, SW	None (IMCO)	1000 ppm		1·26 1·30 1·31	IN, UK G, SW, IT, CZ AU, RIO				0	0 1000 ppm	0 All metals			0 0·40
29	1-1- Difluoroethane (Ethylidene fluoride)	152a	CH_3CHF_2	LL	Yes	No	No			R	$\boxed{A}\boxed{II}$ EXT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ RH – UK, NZ, SW EXT-W 21·8 x 1·814 RH – G, IT, IS, PL		16·17	AU	21·08	AU			5 to 17 (IMCO)			0·68	AU				1 3·7 – 18 %	0 Over 500 ppm	0 All metals			0 4·43
30	1-1- Difluoroethylene (Vinylidene fluoride)	1132a	$CH_2=CF_2$	LL	Yes	No	No				$\boxed{A}\boxed{II}$ EXT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ RH — UK, NZ, SW EXT-BSP 21·8 x 1·814 RH – G, IT, IS, PL								2·3 to 25 (IMCO)								1 5·5 – 21·3 %	0 Over 500 ppm	0 All metals			1 76·42
31	Dimethylamine ㉚		$(CH_3)_2NH$	LL	Yes	No	No	+164·6	+ 6·9	R	$\boxed{A}\boxed{II}$ EXT-W 21·8 x 1·814 LH—G, H, PL EXT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ LH— AU		6·19 5·98	IN AU	10 12 17·43	SW G IT CZ RIO AU	5	SW, RIO, CZ	2·8 to 14·4 (G, IMCO)		Copper and its alloys	0·44 0·59	IN, UK, AU SW, IT, CZ, RIO, G, ICC			IMCO—Suffocating in low concentrations.	1 2·8 – 14·4 %	1 10 ppm	2 St, SS, Al	Br, H, Cu		0 0·78
32	Dimethyl ether (Methyl oxide Methyl ether) ㉙		$(CH_3)_2O$	LL	Yes	No	No	+126·9	− 24·8	R	$\boxed{A}\boxed{II}$ EXT-W 21·8 x 1·814 LH – G, H, PL INT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ LH – AU		15·47 15·82	IN AU	18 16 21·09	SW, G, IT, CZ RIO. AU	5	SW, RIO, CZ	2 to 27 (G) 4 to 50 (IMCO)			0·66 0·68 0·61	IN, UK, AU SW, G, IT, CZ RIO				1 3·4 – 18 %	0 Over 500 ppm	0 All metals			0 4·22
33	Dimethylpropane		C_5H_{12}	LL	Yes	No	No				$\boxed{A}\boxed{II}$ EXT-W 21·8 x 1·814 LH – CZ, PL EXT-SI 21·8 x 1·814 LH – R																1 1·4 – 7·5 %	0 1000 ppm	0 All metals			0 9·48
	Divinyl	See Butadiene																														
	1-2-Epoxyethane	See Ethylene oxide																														

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34	Ethane ㉚	170	C_2H_6	HL	Yes	No	No	+32·1—IN +32·4—G	−88·6		$\boxed{A\;III}$ EXT-W 21·8 × 1·814 LH—CZ, G, H, PL, SW INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—AU		105·5	AU	120 133·6	RIO, G, SW, CZ, IT AU	5	SW, CZ	3·0 to 15·5 (G) 3·0 to 16 (IMCO)			0·32 0·29 0·30 0·36	IN, UK, AU CZ, G, IT, SW RIO ICC				1 3·0–12·5 %	0 Over 500 ppm	0 All metals			1 37·7
35	Ethylamine (Aminoethane)		$C_2H_5NH_2$	LL	Yes	Yes	No	+183·6	+16·6	R	$\boxed{A\;II}$ EXT-BSP $\frac{1}{2} \times \frac{1}{14}$ LH—IN, UK, AU EXT-W 21·8 × 1·814 LH—G, H, PL	18	4·15 3·07	IN AU	10 17·93	SW, G, IT, CZ, RIO AU	5	SW, CZ	3·5 to 14·0 (G) 3·5 to 14·0 (IMCO)	25 ppm	Copper and its alloys	0·60 0·61	UK, IN SW, G, IT				1 3·5–14 %	1 10 ppm	2 St	Cu, Br		0 0·15
36	Ethylchloride (Chloroethane)	160	C_2H_5Cl	LL	Yes	No	No.	+187·2	+12·3	R	$\boxed{A\;II}$ EXT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—IN, UK, AU EXT-W 21·8 × 1·814 LH—CZ, G, D, H, NO, PL, SW	8	4·22 4·22	IN AU	10 17·93	SW, G, IT, CZ, RIO, R AU	5	SW, CZ	3·6 to 14·8 (G) 3·5 to 15 (IMCO)	1000 ppm		0·79 0·80	IN, UK, AU SW, IT, RIO, G, CZ, R				1 3·8–15·4 %	0 1000 ppm	0 Br, Cu, M, SS, St	Al		0 0·35
37	Ethylene ㉚	1156	C_2H_4	HL ⑭	Yes	No	No	+9·7—IN +9·9—G	−103·7	R	$\boxed{A\;III}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—IN, UK, AU, NZ, SA, IR EXT-W 21·8 × 1·814 LH—CZ, G, H, IS, NO, PL, SW	4	147·7	AU	225 189·8	G, SW, IT, CZ, RIO, R AU	5	SW, CZ	2·7 to 34 (G) 3 to 34 (IMCO)			0·31 0·29 0·34 0·28 0·29	ICC IN, UK, AU IT, CZ, G, SW R RIO				1 3·1–32 %	0 Over 500 ppm	0 All metals			3 86·37
38	Ethylene oxide (1-2 Epoxyethane, Oxirane)		C_2H_4O	LL	Yes	Yes		+192	+10·6	R	$\boxed{D\;I}$ EXT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—IN, UK, AU EXT—W 21·8 × 1·814 LH—CZ, G, H, PL, SW	6	4·02	AU	10 17·58	G, SW, IT, CZ, RIO, R AU	5	SW, CZ	2·6 to 100 (G) 3 to 100 (IMCO)	50 ppm	Copper	0·76 0·78 0·77 0·716	IN, UK, AU CZ, G, IT RIO R			IT—To be transported only if free of impurities like acids, bases, chlorides, etc, which contribute to its polymerization.	5 3·0–100 %	1 50 ppm	0 St	Cu, Br		0 0·49
	Ethylidene fluoride	See Difluoroethane																														
39	Fluorine ㉚		F_2	P	No	Yes	Yes				$\boxed{D\;II}$ EXT-W 25·4 × 3·175 RH—CZ, G, H, PL EXT-NGO 1·030 × $\frac{1}{14}$ LH—FR, SW				200	SW, CZ	2	SW, CZ	None (IMCO)		Copper and its alloys		⑱	28 28·12	SW, CZ ICC (at 70 °F)	IMCO—Reacts violently with practically all substances. Explodes when mixed with hydrogen. Highly oxidizing. SW—To be protected from oil and similar substances.	4	1 0·1 ppm	3 All metals if dry, otherwise 4			2 21·09
40	Helium ㉚		He	P	No	No	No			O	$\boxed{C\;II}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—IN, UK, AU, NZ, SA EXT-W 21·8 × 1·814 RH—G, H, PL	3			1·5p	R, CZ								200 250	RIO, CZ, G CZ ⑩		0	0 Over 500 ppm	0 All metals			3 154·7
41	Hexafluoropropylene			L (CGA)																							0	0 Over 500 ppm	0 All metals			0 5·98
42	Hydrogen ㉚		H_2	P	Yes	No	No	−239·9	−252·8	O	$\boxed{A\;III}$ INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH—IN, UK, AU, NZ, SA, IR EXT-W 21·8 × 1·814 LH—CZ, G, D, H, NO, PL, SW	4			1·5p	R, RIO, G, SW	5	SW	4·0 to 75 (G, IMCO)					200 250	G G, SW ⑩	SW—Maximum oxygen impurity allowed is 2 % by volume	1 4·0–75 %	0 Over 500 ppm	0 All metals			3 140·6
	Hydrogen (Heavy)	See Deutrium																														
43	Hydrogen bromide (Anhydrous)		HBr	LL	No	Yes	Yes	+89·8	−66·7		$\boxed{D\;IV}$ EXT-W 25·4 × 3·175 RH—H, IT, SW EXT-NGO 0·825 × $\frac{1}{14}$ LH—AU				60	SW, CZ, G, IT	2	SW, CZ	None (IMCO)	5 ppm	Light metal alloys	1·20	SW, G, IT, CZ			CGA—Very toxic, but good warning.	0	1 3 ppm	3 All metals if dry, otherwise M			0 22·50
44	Hydrogen chloride (Anhydrous) ㉚		HCl	LL ⑲	No	Yes	Yes	+51·4	−85·0	P	$\boxed{D\;IV}$ EXT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—IN EXT-W 25·4 × 3·175 RH—FR, IT, H, PL, SW	5	106·6 108·52	AU IN	133·6 200 120	AU G, SW RIO, CZ	2	G, SW, RIO, R, CZ	None (IMCO)	5 ppm		0·42 0·48 0·57 0·60 0·74	IN, UK, AU CZ RIO ICC SW, G			CGA—Very toxic, but good warning.	0	1 5 ppm	3 All metals if dry, otherwise M			1 43·10

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45	Hydrogen cyanide (Anhydrous) (30)		HCN	LL	Yes	Yes	No	+183·5	+ 25·7		$\boxed{D}\boxed{I}$ EXT-W 26·4 x 3·175 RH-H EXT-NGO 0·825 x $\frac{1}{14}$ LH-AU		2·61	IN	100	G, IT			5·6 to 46·6(G) 5·6 to 40 (IMCO)	10ppm		0·57 0·55	IN, UK IT, G			IMCO-May cause poisoning by inhalation of gas by penetration of liquid or vapours of high concentration through the skin. If not properly stabilized can polymerize violently.	1 6-41 %	2 10 ppm	1 All metals if dry, otherwise M			0 < 35·
46	Hydrogen fluoride (Anhydrous)		HF	LL	No	Yes	Yes		+ 20 (IMCO)	P	$\boxed{D}\boxed{IV}$ EXT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ RH-IN EXT-W 25·4 x 3·175 RH-H, IT, SW EXT-NGO 0·825 x $\frac{1}{14}$ LH-AU	5	3·09 2·46	IN AU	10	RID, SW, G, IT	2	SW, RID, CZ	None (IMCO)		Metals and glass (in presence of water)	0·60 0·64	IN, UK, AU RID, IT, SW, CZ			CGA-Very toxic, but good warning. IMCO-Causes very dangerous skin burns.	0	1 3 ppm	3 All metals if dry, otherwise M			0 0·06
47	Hydrogen sulphide (34)		H_2S	(3) LL	Yes	Yes	No	+ 100	- 60·3	P	$\boxed{D}\boxed{I}$ EXT-BSP $\frac{3}{8}$ x $\frac{1}{19}$ LH-UK EXT NGO 0·825 x $\frac{1}{14}$ LH-AU		48·86 48·16	IN AU	53 63·28	IT, CZ, SW, G AU	2	CZ, SW, G, R	4 to 46 (IMCO) 4·3 to 45 (G)	20ppm	Fine silver, copper and copper alloys	0·63 0·67 0·68	UK, IN, AU SW, G, IT, CZ ICC				1 4·3-45 %	2 10 ppm	1 Al, St, Br			0 17·58
48	Isobutane (2-Methyl Propane) (30)	600a	$CH(CH_3)_3$	LL	Yes					R	$\boxed{A}\boxed{II}$ EXT-W 21·8 x 1·814 LH-CZ, G, PL INT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ LH-AU		8·78 8·79	IN AU	10 12 17·58	SW, IT, CZ RID AU	10 5	SW CZ (6)				0·47 0·49	IN, UK SW, RID, CZ, IT, AU				1 1·8-8·8 %	0 Over 500 ppm	0 All metals			0 2·48
49	Isobutylene (30)		$CH_2{=}C(CH_3)_2$	LL	Yes						DITTO		7·73	AU	10 17·58	CZ, SW, IT, RID, R AU	10 5	SW CZ (6)				0·52 0·53 0·526	IT, CZ, SW AU, RID R				1 1·8-8·8 %	0 Over 500 ppm	0 All metals			0 1·69
50	Krypton (30)		Kr	P							$\boxed{C}\boxed{II}$ INT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ RH-UK EXT-W 21·8 x 1·814 RH-G, H, PL				1·5p	SW, CZ, R	5	SW, CZ						200 250	G, CZ, RID (16) SW, CZ		0	0 Over 500 ppm	0 All metals			3 56·25
	Lighting Gas	See Coal gas																														
	LPG (Liquefied Petrolium Gases) (30)	See (37)																														
51	Methane (Coal Damp Gas, Natural Gas) (30)	50	CH_4	P	Yes	No	No	-82·4	-161·5	O	$\boxed{A}\boxed{II}$ INT-BSP $\frac{5}{8}$ x $\frac{1}{14}$ LH—IN, UK, AU EXT-W 21·8 x 1·814 LH-CZ, G, H, NO, PL, SW	4			1·5p	R, RID, G	5	CZ	5·0 to 15·0(G) 5 to 16 (IMCO)					200 250	RID, G, CZ CZ		1 5·3-14 %	0 Over 500 ppm	0 All metals			3 154·7
52	Methanethiol (Methylmercaptan) (30)		CH_3SH	LL	Yes	Yes		+196·8	+ 6·0		$\boxed{D}\boxed{I}$ EXT-W 21·8 x 1·814 LH-CZ, G, H, PL EXT-NGO 0·825 x $\frac{1}{14}$ LH-AU				10	SW, G	5	SW, RID	4·1 to 21 (G) 4 to 22 (IMCO)	50ppm		0·78 0·80	SW, G ICC			CGA-Very toxic, but good warning.	1 2·5-17 %	1 10 ppm	1 SS			0 1·05
53	Methyl acetylene		$CH_3C{\equiv}CH$	LL	Yes						$\boxed{A}\boxed{II}$																1 2·4-11·7 %	0 1000 ppm	0 All metals except Cu, Br			0 4·22
54	Methylamine (Aminomethane) (30)	630	CH_3NH_2	LL	Yes	Yes		+156·9	- 6·6	P	$\boxed{A}\boxed{II}$ EXT-BSP $\frac{1}{2}$ x $\frac{1}{14}$ LH—IN, UK	10	10·97 10·55	IN AU	13 14 17·58	IT, G, CZ RID AU	5	CZ	5·0 to 20·7(G) 4·3 to 21 (IMCO)		Copper and copper alloys	0·54 0·58 0·60	IN, UK, AU CZ, G, IT RID			IMCO-Suffocating in low concentrations.	1 4·9-20·7 %	1 10 ppm	2 St	Cu, Br		0 2·18
	Methyl oxide	See Dimethyl ether																														
55	Methyl bromide (Bromomethane)		CH_3Br	LL	No	Yes			+ 4·6	P	$\boxed{D}\boxed{III}$ EXT-BSP $\frac{1}{4}$ x $\frac{1}{19}$ RH-UK EXT-W 25·4 x 3·175 RH-G, H, SW	-	7·10 5·98	IN AU	10 17·58	SW, CZ, IT, RID AU	5	CZ, SW, RID	13·5 to 14·5 (IMCO)			1·39 1·51 1·45	IN, UK, AU CZ, IT, SW RID			SA-Not to be transported in welded cylinders.	0 13·5-14·5 %	2 20 ppm	0 Br, Cu, St, M, SS	Al		0 0·91

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56	Methyl chloride (Chloromethane) ㉓	40°	CH_3Cl	LL	Yes	Yes		+143·8	−24·2	R	$\boxed{O}\boxed{I}$ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — IN, UK, AU EXT-W 21·8 × 1·814 LH — G, H, NO, PL, SW	6	14·66 14·76	IN AU	17 16 21·09	SW, IT, G, CZ R AU	5 2	SW, RIO, CZ R	1·6 to 19·6 (G) 8 to 20 (IMCO)			0·78 0·81 0·80 0·82 0·84	IN, UK CZ, IT, G, SW RIO, R AU ICC				1 10·7–17·4 %	1 100 ppm	0 All metals except Al, Zn			0 4·16
	Methyl ether	See Dimethyl ether																														
57	Methyl fluoride	41	CH_3F	LL	Yes						$\boxed{A}\boxed{II}$ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — UK, SW, NZ EXT-W 21·8 × 1·814 RH — G, IT, IS, PL																1	0 Over 500 ppm	0 All metals			1 38·37
	2-Methyl Propane	See Isobutane																														
	Methyl vinyloxide (Methyl vinyl ether)	See Vinyl methyl ether																														
58	Methyl ethyl ether (Methyl ethyl oxide, Methoxyethane)		$C_2H_5OCH_3$	LL	Yes	No	No				$\boxed{A}\boxed{II}$ EXT-W 21·8 × 1·814 LH — H, PL								2 to 10 (IMCO)								1 2–30 %	0 Over 500 ppm	0 All metals			0 <35·15
59	Monochlorodifluoro-ethane	142 b	CF_2ClCH_3	LL	Yes	No	No	+137·1	−9·2	R	$\boxed{A}\boxed{II}$ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH — UK, NZ, SW EXT-W 21·8 × 1·814 RH — G, IT, IS, PL		5·98	AU	10 17·58	G, SW AU	5	SW, RIO	6·4 to 18·5 (G) 8·5 to 14 (IMCO)			0·98 0·99 1·00	AU SW, G ICC				1 9·0–14·8 %	0 Over 500 ppm	0 All metals			0 >35·15
60	Monobromotrifluoro-methane	13 B_1	$CBrF_3$		No						EXT NGO 1·030 × $\frac{1}{14}$ RH — $\boxed{C}\boxed{III}$ PR, NZ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH — IN, UK, NZ, SW EXT- W 21·8 × 1·814 RH — G, IT, IS, PL				120	SW	5	SW, RIO			Copper and copper alloys.	1·44	SW				0	0 1000 ppm	0 All metals			0 13·38
61	Monochlorodifluoro-methane ㉓	22	$CHClF_2$	③ LL	No					R	D I T T O	5	26·72 26·09	IN AU	29 27 30 33·75	CZ, SW, IT RIO R AU	5	SW, RIO, CZ	None (IMCO)			0·90 1·03 0·98 1·00 1·05	IN, UK CZ, SW, IT, AU RIO R ICC				0	0 1000 ppm	0 All metals			0 8·65
62	Monochloromonobromodifluoromethane	12 B_1	$CClF_2Br$		No						D I T T O				10	SW	5	SW RIO	None (IMCO)			1·61	SW				0	0 Over 500 ppm	0 All metals			0 <35·15
63	Monochlorotetra-fluoroethane	124 a	CHF_2CClF_2	LL	No					R	D I T T O		5·98	AU	17·58	AU			None (IMCO)			1·15	AU				0	0 Over 500 ppm	0 All metals			0 <35·19
64	Monochlorotrifluoro-ethane	133 a	CH_2ClCF_3		No						D I T T O				10	CZ, IT, SW	5	SW, RIO, CZ				1·20	SW, CZ, IT				0	0 Over 500 ppm	0 All metals			0 <35·15
65	Monochlorotrifluoro-ethylene	1113	$CClF=CF_2$	③ LL	⑪ No			+107	−27·9	R	D I T T O		16·62	AU	21·09 19 18	AU G, SW CZ	5	SW, RIO, CZ	24·0 to 40·3 (G)			1·00 1·03 1·13 1·15	AU CZ SW, G ICC			CGA — Shipped inhibited with tributylamine but can polymerize if inhibitor is removed.	5 8·4–38·7 %	1 20 ppm	0 All metals			0 4·36
66	Monochlorotrifluoro-methane ㉕	13	$CClF_3$		No					R	D I T T O	5	91·40	AU	96 100 119·5	R CZ, IT, SW AU	5	SW, RIO, CZ	None (IMCO)			0·96 0·60 0·90 0·83 1·00	AU R IT, CZ SW ICC				0	0 1000 ppm	0 All metals			0 32·20
	Natural Gas	See Methane																														

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67	Neon [illegible]		Ne	P				-228·7		0	C II INT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—UK,IN	3			1·5p	R,G,SW	5	SW,CZ,RIO						200 250	G,CZ,RIO G,SW,CZ [illegible]		0	0 Over 500 ppm	0 All metals			3 126·6
68	Nitric oxide		NO		No	Yes	Yes				D II EXT-W 21·8 x 1·814 RH—AU INT-ISO 26 x 1·50 RH—FR								None (IMCO)							IMCO—On contact with air gives off brown fumes which are poisonous by inhalation with delayed effects, similar to phosgene.	4	2 25 ppm	1 SS			3 35·15
69	Nitrous oxide [illegible]	744a	N_2O	HL	No	No	No	36·4 (G) 36·5 (IN)			B III EXT-W 17·46 x 1·270 RH—IN,UK,IR,SA EXT-BSP $\frac{3}{8} \times \frac{1}{19}$ RH—CZ,G,D,NO,PL,SW	12							None (IMCO)			0·667 0·68 0·75	IN,UK,AU ICC SW,G,RIO			SW—To be protected from oil, fat and similar substances.	2	0 Over 500 ppm	0 All metals			1 52·38
70	Nitrogen [illegible]		N_2	P	No	No	No				C I INT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH—IN,UK,SA,NZ,IR EXT-W 24·32 x 1·814 RH—CZ,G,D,NO,PL,SW	3										0·68	ICC (for liquefied)	200 250	G,RIO G,SW [illegible]		0	0 Over 500 ppm	0 All metals			3 154·7
71	Nitrogen peroxide Nitrogen dioxide Nitrogen tetroxide Dinitrogen tetroxide		NO_2 N_2O_4	LL	No	Yes	Yes	+158	+21·1	P	D II EXT-BSP $\frac{1}{2} \times \frac{1}{14}$ RH—AU EXT-W 25·4 x 3·175 RH—G,H,SW		5·27	AU	250 58·25 10 20	IT,CZ AU IT,CZ,G,SW RIO	2	G,SW,RIO,CZ		pm	Steel, oil, fat and grease	0·75 1·30 1·20 1·35	IT,CZ IT,CZ,SW,G AU RIO			SW—To be protected from oil, fat and similar substances. IMCO—Poisonous by inhalation, with delayed effects, similar to phosgene. May cause fire on contact with organic materials such as sawdust or cotton.	4	2 5 ppm	1 SS			0 1·05
72	Nitrosyl chloride		$NOCl$	LL	No	Yes	Yes			P	D IV EXT-W 25·4 x 3·175 RH—CZ,FR,H,NO,PL EXT-BSP $\frac{1}{2} \times \frac{1}{14}$ RH—AU		9·70 10·19	IN AU	47·11	AU			None (IMCO)		Iron, steel	1·04 1·10 1·16	IN,UK ICC AU			IMCO—Irritates mucous membranes. CGA—Very toxic but good warning.	0	1 3-5 ppm	3 M,Ni	Most of metals		0 1·90
73	Nitrox			P													5	CZ						200 250	CZ CZ							
74	Octafluorocyclobutane		C_4F_8	LL	No			+115·0	-6·1						10	G			None (IMCO)			1·34	G				0	0 Over 500 ppm	0 All metals			0 1·78
75	Oil gas, compressed		CO, C_mH_n	P	Yes	Yes	No								1·6p	G			5 to 33 (IMCO)					200	G							
76	Oil gas, liquefied (Z gas)		CO, C_mH_n	LL	Yes	Yes									40	G,IT						0·37	IT,G									
	Oxirane	See Ethylene oxide																														
77	Oxygen [illegible]		O_2	P	No	No	No	-118·4	-182·97	0	B II INT-W 22·92 x 1·814 RH—IN,UK,IR,NZ,SA,FR EXT-W 21·8 x 1·814 RH—CZ,N,D,H,IS,NO,SW	3			1·6p	SW,R,G	5	RIO,SW	None (IMCO)		Steel, oil and grease	0·96	ICC (for liquefied)	200 250	G,RIO SW,G [illegible]	SW—Max hydrogen impurity allowed is 3%.	4	0 Over 500 ppm	0 All metals			3 15[illegible]·7

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78	Ozone		O_3	D (CGA)																							4	1 0·1 ppm	0 SS			9 33·48
79	Phosgene (Carbonyl chloride) ㉞		$COCl_2$	LL	No	Yes	Yes	+182	+7·6	P	D IV EXT — BSP $\frac{5}{8} \times \frac{1}{14}$ RH — IN, UK, AU EXT-W 25·4 × 3·175 RH — CZ, G, D, H, NO, PL, SW	5	5·13 5·27	IN AU	20 30 56·25	SW, RIO, IT, G, CZ R AU	2 5	SW, G, R, CZ RIO	None (IMCO)	·1 pm	Rubber	1·19 1·23 1·25	IN, UK, AU IT, G, CZ, SW RIO, R			SA — Not to be transported in welded cylinders. IMCO — Dangerous because it may be inhaled without immediate effect but causing severe damage and death after few hours.	0	2 0·1 ppm	3 All metals if dry, otherwise M			0 0·77
80	Propane ㉞㉘	290	C_3H_8	LL ③	Yes	No	No	+96·8	−42·1	R	B II EXT-W 21·8 × 1·814 LH — CZ, G, IR, H, IN, PL EXT-SI 21·8 × 1·814 LH — FR, IN, R INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH — IN, UK, NZ, AU, UK, IR	4,8	22·92 26·01	IN AU	26 30 25 33·75	IT, SW, G, CZ RIO, IT R AU	10 5	SW RIO, CZ	2·1 to 9·5 (G)		Natural rubber	0·40 0·42 0·425 0·43	IN, UK SW, IT, CZ, G, AU R RIO				1 2·2–9·5 %	0 1000 ppm	0 All metals			0 7·73
81	Propene ㉞㉘	1270	C_3H_6	LL ③	Yes	No	No	+91·8	−47·7		A II INT-BSP $\frac{5}{8} \times \frac{1}{14}$ LH — AU EXT-W 21·8 × 1·814 LH — CZ, G, H, PL		27·21 27·07	IN AU	30 35 25 33·75	IT, SW, G, CZ RIO R AU	10 5	SW RIO, CZ	2·0 to 11·1 (G)			0·45 0·40 0·43 0·44 0·445	RIO IN, UK IT, CZ, SW, G AU R				1 2·4–10·3 %	0 Over 500 ppm	0 All metals			0 9·56
82	Rare gas mixture (He, Ne, Ar, Kr)			P	No	No	No								1·5p	G								200 250	G G							
83	Rare gas mixture (As above + N_2)			P	No	No	No								1·5p	G								200 250	G G							
84	Rare gas mixture (As above + O_2)			P	No	No	No								1·5p	G								200 250	G G							
	Refrigerant Gases	See ㉙ ㉟ and ㊱																														
85	Silicon tetrafluoride		SiF_4		No	Yes	Yes				D IV										Metals					IMCO — In moist air produces hydrogen fluoride which irritates mucous membranes and respiratory system.	0	1 3 ppm	3 All metals if dry, otherwise M, SS			3 58·43
86	Sulphur dioxide (Sulphurous acid) ㉚	764	SO_2	LL	No	Yes	Yes	+157·5	−10	P	D IV EXT-BSP $\frac{1}{2} \times \frac{1}{14}$ RH — AU, UK, IN, R EXT-W 22·92 × 1·814 RH — CZ, G, D, NO, PL, SW	11	11·60	AU	14 12 20 17·93	SW, G, CZ RIO, R IT AU	2	CZ, SW, RIO, G, R		ppm	Nickel	1·19 1·23 1·25	IN, UK IT, CZ, SW, AU, G R, ICC, RIO			CGA — Very toxic, but good warning	0	1 5 ppm	1 All metals if dry, otherwise SS			0 2·46
87	Sulphur hexafluoride ㉚		SF_6	LL ⑩	No	Yes		+45·5	−63·7 (Sublimated)	R	C I EXT-BSP $\frac{5}{8} \times \frac{1}{14}$ RH — IN, UK, AU, NO, SW EXT-W 21·8 × 1·814 RH — G, H, IT, PL	5	49·92	AU	70 117·6	RIO, SW, G, CZ AU	5	SW, CZ, RIO		1000 ppm		0·75 1·04 1·08 1·10	IN, UK, AU, RIO SW, G CZ ICC				0	0 1000 ppm	0 All metals			0 21·80
88	T-gas (28)		C_2H_4O – 90% CO_2 – 10% by weight	HL (as per IT)	Yes	Yes									28	G, IT			3 to 100 (G)			0·73	G, IT									
	T-gas (250)	See Cartox																														

Note — Numbers within circles refer to note numbers given in clause 2.1.

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1	2	3	4	5	6	7	8	9	10	11	12	13	14		15		16		17	18	19	20		21		22	23					
89	Tetrafluoroethylene	1114	$CF_2=CF_2$																			0·98	ICC			CGA — Capable of explosive polymerization.	5 14-43 %	0 Over 500 ppm	0 All metals			0 20·11
	Town gas	See Coal gas																														
90	Trichlorofluoro-methane	11	CCl_3F	HL	No	No	No	+28·8 (IN)			EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH—IN, $\boxed{C}\boxed{III}$ UK, SW, NZ EXT-W 21·8×1·814 RH—G, IT, IS, PL EXT-NGO 1·030×$\frac{1}{14}$ RH—NZ, FR	5	11·81	IN	10 30	RIO R			None (IMCO)			0·98 1·20 1·35	IN, UK R RIO				0 	0 Over 500 ppm	0 All metals			0 0·09 Vacuum
91	1.1.2 Trichlorotrifluoro-ethane	113	CCl_2FClF_2	③ L																							0 	0 Over 500 ppm	0 All metals			0 <35·15 (Liquid)
92	Trifluoromethane		CHF_3	HL	No			+26	-82·2						250	G, SW	5	RIO, SW				0·95	SW, G									
93	Trifluoromono-bromomethane		⑩ CF_3Br	LL	No	No	No	+66·9	-57·8						120	G			None (IMCO)	100 ppm		1·44	G									
94	Trimethylamine ⑯		$(CH_3)_3N$	LL	Yes	Yes	No	+160·2	+2·9	R	$\boxed{A}\boxed{II}$ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — AU EXT-W 21·8×1·814 LH — G, H, PL		5·69 5·62	IN AU	10 17·58	SW, RIO, G, IT, CZ AU	5	SW, RIO, CZ	2 to 12 (IMCO) 2·0 to 11·6 (G)		Copper and copper alloys	0·61 0·34 0·66 0·57	UK, IN AU SW, CZ, G, IT RIO, ICC			IMCO — Suffocating in low concentrations.	1 2·0-11·6 %	1 25 ppm	2 St, SS, M, Al	Copper and its alloys		0 1·41
95	Vinyl bromide		$CH_2=CHBr$	LL	Yes	No	No	+200	+15·8		$\boxed{A}\boxed{I}$ EXT-W 21·8×1·814 LH — G, H, PL EXT-W 20×1·814 LH — IT				10	SW, RIO, CZ, G, IT	5	SW, G, CZ				1·37 1·25	SW, IT, G, CZ RIO			CGA — Shipped inhibited with phenol but if phenol is removed, it can polymerize. IT — Admissible for transport if properly stabilized.	5 	1 500 ppm	0 St, SS	Cu, Br		0 0·35
96	Vinyl chloride ㉖	1160	$CH_2=CHCl$	LL	Yes	No	No	+142 to +156·6	-13·4	R	$\boxed{B}\boxed{I}$ ㉑ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — IN, UK, AU EXT-W 21·8×1·814 LH — G, H, PL, SW	6	9·49	AU	11 17·58	SW, G, RIO, IT, CZ AU	5	SW, RIO, CZ	4 to 31 (IMCO) 3·9 to 31 (G)	500 ppm		0·78 0·91 0·90 0·94	IN, UK, AU G, IT, CZ, SW RIO ICC			CGA — Shipped inhibited with phenol but if phenol is removed, it can polymerize. IT — Admissible for transport if properly stabilized.	5 4-22 %	1 500 ppm	0 St, SS	Cu, Br		0 2·39
	Vinyl ethylene	See Butadiene																														
97	Vinyl fluoride ⑯	1161	$CH_2=CHF$	⑩ LL	Yes		No	+54·7	-72		$\boxed{A}\boxed{II}$ EXT-W 21·8×1·814 LH — G, IT, IS, PL EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — UK, NZ				250	G			2·9 to 29·9 (G, IMCO)			0·62 0·64	ICC G			IMCO — Liable to polymerization. CGA — Shipped inhibited with terpene B, but if this is removed, it can polymerize.	5 2·5-21·5 %	1 Over 500 ppm	0 St, SS			0 24·98
98	Vinyl methyl ether ⑭ (Methyl vinyl ether, Methyl vinyl oxide)		$CH_3OCH=CH_2$	LL	Yes	Yes			+6·0	R	$\boxed{A}\boxed{II}$ ㉑ EXT-BSP $\frac{5}{8}\times\frac{1}{14}$ LH — AU EXT-W 21·8×1·814 LH — G, H, PL		5·62	AU	10 17·58	SW, G, IT, CZ RIO AU	5	SW, CZ, RIO				0·97 0·65 0·60 0·68	SW, G, CZ, IT RIO AU ICC			IT — Admissible for transport only if properly stabilized.	5 1·7-25 %	1 Over 500 ppm	0 St, SS, Al	Cu, Br		0 1·97
	Vinylidene fluoride	See Difluoroethylene																														

Note — Numbers within circles refer to note numbers given in clause 2.1.

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TECHNICAL DATA SHEET FOR GASES CONVEYED IN CYLINDERS

SERIAL NUMBER	ALPHABETIC NAME OF THE GAS	REFRIGERANT NUMBER ACCORDING TO ISO/R 817	CHEMICAL FORMULA	PERMANENT (P), LIQUEFIABLE (L), HIGH PRESSURE LIQUEFIABLE (HL), LOW PRESSURE LIQUEFIABLE (LL), DISSOLVED (D) (See also col 23)	WHETHER FLAMMABLE (See also col 17 and 23)	WHETHER TOXIC, HARMFUL, POISONOUS (See also col 18 and 23)	WHETHER CORROSIVE (See also col 19 and 23)	CRITICAL TEMPERATURE, °C ①	BOILING POINT AT 760 TORR, °C ①	SAFETY DEVICE REQUIRED (R), OPTIONAL (O), PROHIBITED (P)	CLASSIFICATION CATEGORY FOR VALVE OUTLET ACCORDING TO ISO/TC 58/SC 2 (Secn-58)119 AND TYPE OF PREVALENT VALVE OUTLETS IN VARIOUS COUNTRIES				VALVE OUTLET NUMBER ACCORDING TO IS : 3224-1971	VAPOUR PRESSURE OR SERVICE PRESSURE 'p' (See also col 23)		MINIMUM TEST PRESSURE PRESCRIBED IN VARIOUS COUNTRIES (SYMBOL 'p' USED IN THIS COLUMN STANDS FOR SERVICE PRESSURE SPECIFIED IN COL 14)		PERIODICAL INSPECTION INTERVAL PRESCRIBED IN VARIOUS COUNTRIES		IGNITION RANGE IN AIR % BY VOLUME (See also col 23)	TOXICITY AND MAX VALUE (See also col 23)	UNSUITABLE OR PROHIBITED MATERIALS (See also col 23)	FILLING RATIO FOR LIQUEFIABLE GASES PRESCRIBED IN VARIOUS COUNTRIES		MAXIMUM FILLING PRESSURE FOR PERMANENT GASES AT 15°C PRESCRIBED IN VARIOUS COUNTRIES ④		REMARKS	GAS CLASSIFICATION ACCORDING TO CODE OF COMPRESSED GAS ASSOCIATION, U.S.A.					
											A Flammable Gases	B Fuel, Oxidizing, Combustion Assisting Gases	C Neutral, Inert Gases	D Toxic, Poisonous, Harmful Gases		kgf/cm²	Country	kgf/cm²	Country	Year	Country				Filling Ratio	Country	kgf/cm²	Country		Flammability (See also col 17)	Toxicity Permitted (See also col 18)	Corrosiveness (See also col 19) Symbols for Metals St - Steel SS - Stainless Steel M - Monel Metal (70:30 CuNi) Br - Brass Al - Aluminium S Suitable metals	U Unsuitable metals	NR Metals not recommended	Cylinder Pressure, Gauge at 70°F, kgf/cm² (See also col 14)
	2	3	4	5	6	7	8	9	10	11	12				13	14		15		16		17	18	19	20		21		22	23					
99	Volcanic gas		H_2+CH_4	P	Yes													1·5p	G			6 to 70 (G,MCO)					200	G							
100	Water gas		H_2+CO	P	Yes	Yes	No											1·5p	G								200	RIO							
101	Xenon		Xe	HL	No						C II INT-BSP $\frac{5}{8}\times\frac{1}{14}$ RH — UK, AU EXT-W 21·8 × 1·814 RH — G, H, PL																			0	0 Over 500 ppm	0 All metals			0 43·96
	Z-gas	See Oil gas liquefied																																	

Note - Numbers within circles refer to note numbers given in clause 2.1.

AMENDMENT NO. 2 AUGUST 2009
TO
SP 9 : 1973 TECHNICAL DATA SHEET FOR GASES CONVEYED IN CYLINDERS

(*Page* 4, *clause* **2.1**, *Note* 4, *Heading*) — Substitute the following for the existing:

'*According to German Compressed Gas Regulations for Acetylene*'

(*Page* 6, *clause* **2.1**, *Note* 30) — Add the following at the end:

'However, according to Compressed Gas Association Standard No. CGA S 1.1, only the following gases are prohibited to be fitted with a safety device — Cyanogen, cyanogen chloride, hydrogen cyanide, mustard gas, nitrogen tetraoxide, phosgene.'

(*Page* 7, *clause* **2.1**, *Note* 34(b), *Second Digit — Toxicity*) — Substitute the following for Toxicity 2:

'2 = very toxic: less than 50 ppm permitted'

(*Page* 8, *Table* 3, *col heading Chemical Name, Refrigerant No.* 13) — Substitute '(Mono) chlorotrifluoromethane' *for* '(Mono) bromotrifluoromethane'.

(*Page* 17, *against Sl No.* 20 '*Cyanogen*'):

a) *Column* 9 — Insert '+128'.

b) *Column* 18 — Insert '10 ppm'.

(*Page* 21, *against Sl No.* 38 '*Ethylene oxide*', *col* 8) — Insert 'No'.

(*Page* 21, *against Sl No.* 44 '*Hydrogen chloride*', *col* 5) — Substitute '*HL*' *for* '*LL*'.

(*Page* 23, *against Sl No.* 45 '*Hydrogen cyanide*', *col* 16) — Insert '2 - SW'.

(*Page* 23, *against Sl No*. 46 '*Hydrogen fluoride*', *col* 9) — Insert '+188'.

(*Page* 23, *against Sl No*. 52 '*Methanethiol*', *col* 8) — Insert 'Yes'.

(*Page* 23, *against Sl No.* 55 '*Methyl bromide*', *col* 8) — Insert 'No'.

(*Page* 25, *against Sl No.* 56 '*Methyl chloride*', *col* 8) — Insert 'No'.

(*Page* 25, *against Sl No.* 57 '*Methyl fluoride*', *col* 8) — Insert 'No'.

(*Page* 27, *against Sl No*. 76 '*Oil gas liquefied*', *col* 5) — Substitute '*HL*' *for* '*LL*'.

(*Page* 29, *against Sl No.* 85 '*Silicon tetrafluoride*' *col* 5) — Insert '*P*'.

(*Page* 29, *against Sl No.* 87 '*Sulphur Hexafluoride*', *col* 5) — Insert '*HL*'.

(*Page* 31, *against Sl No.* 92 '*Trifluoromethane*', *col* 3) — Insert '23'.

(*Page* 31, *against Sl No.* 93 '*Trifluoromonobromomethane*'):

a) *Column* 3 — Insert '13B1'.

AMENDMENT NO. 1 JUNE 1978

TO

SP : 9-1973 TECHNICAL DATA SHEET FOR GASES CONVEYED IN CYLINDERS

Alteration

(*Page* 31, *against Sl No.* 90 '*Trichlorofluoromethane*'):

a) *Column* 5 — Substitute 'LL' *for* 'HL'.

b) *Column* 9 — Substitute '198' *for* '28·8'.

c) *Column* 14 — Substitute '2·63' *for* '11·81'.

d) *Column* 20 — Substitute '1·30' *for* '0·90'.

(EDC 16)

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